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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/083,613	02/26/2002	David F. Bliss	AFB00614	3162

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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 09/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/083,613	BLISS ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 15-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. This application contains claims 15-19 are drawn to an invention nonelected with traverse in the Paper filed on 2/21/2003. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-8 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Hirota et al (EP 1 065 299 A2).

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Vaudo et al teaches a method of forming a (gallium, aluminum, indium) nitride base layer on a substrate by halide vapor phase epitaxy (HVPE), note entire reference. Vaudo et al also teaches in the HVPE process, HCl is passed over a source of high purity gallium to form GaCl, which is transported to a deposition zone where it reacts with ammonia to form GaN (col 10, ln 15-67). Vaudo et al also teaches subatmospheric pressure conditions, 50 Torr, employed during growth and further reductions in growth pressure are expected to improve uniformity across the wafer and across multiple wafers within one growth run (col 12, ln 25-40). Vaudo et al also teaches a vessel **64** of molten indium, a vessel **69** of molten gallium and a vessel **67** of molten aluminum (col 11, ln 1-40). Vaudo et al also teaches HCl is flowed in contact with indium to form indium chloride which then is transported to the deposition zone where it reacts with ammonia introduced in feed port **74** to form InN on a substrate. Vaudo et al also teaches flowing HCl into contact with gallium and aluminum to form gallium chloride and aluminum chloride, which are transported to a deposition zone where it reacts with ammonia to form GaN and AlN (col 11, ln 15-40).

Vaudo et al does not teach contacting a heated metal with flowing iodine vapor.

In a method of growing III-V nitride semiconductors, note entire reference, Hirota et al teaches a forming GaN by reacting HCl with Ga in a container to form GaCl and reacting the GaCl with nitrogen plasma to form a GaN layer **20** ([0055]). Hirota et al also teaches iodine (I₂) may be introduced as a halogen molecule instead of HCl ([0058]). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Vaudo et al flowing HCl with Hirota et al's iodine vapor instead of HCl because substitution of known equivalents for the same purpose is held to be obvious. (MPEP 2144.06).

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Referring to claim 2-4, the combination of Vaudo et al and Hirota et al teaches subatmospheric pressures. Vaudo et al does not teach the claimed range of pressure. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 5, the combination of Vaudo et al and Hirota et al teaches Ga, Al and In.

Referring to claim 6, the combination of Vaudo et al and Hirota et al teaches (Ga, Al, In)N.

Referring to claim 7, the combination of Vaudo et al and Hirota et al teach the MI is formed in one locale and then is flowed to another locale to react with ammonia to form MN ('581 Fig 2).

Referring to claim 8, the combination of Vaudo et al and Hirota et al teach deposition on a substrate 56.

Referring to claims 13-14, the combination of Vaudo et al and Hirota et al teach the same reactants and products as applicant, therefore the reaction chemistry is inherently the same as claimed.

4. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Hirota et al (EP 1 065 299 A2) as applied to claims 1-8 and 13-14 above, and further in view of Jain (US 4,910,163).

The combination of Vaudo et al and Hirota et al teach all of the limitations of claim 9, as discussed previously, except iodine is placed in a first boat upstream in an elongated first container below an inlet for H₂.

Jain teaches a chemical vapor deposition apparatus, where a continuous tubular reactor is divided into three zones. Jain also teaches in the first zone an iodine boat contains iodine crystals and a resistance heater to elevate the temperature so that iodine is vaporized and admixes with a carrier gas of hydrogen, in the center of the reactor is packed with silicon and in the last zone contains a substrate (col 2, ln 20 to col 3, ln 67). Jain also teaches the iodine and carrier gas passes through the silicon and the iodine reacts with silicon to produce silicon diiodide, which then exits as a part of the gas stream and the silicon diiodide is disproportionated and silicon is deposited on a substrate (col 1, ln 50-67). Jain also teaches the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing (col 1, ln 1-45 and col 4, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al and Hirota et al with Jain's apparatus with iodine in first boat upstream because the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing, thereby increasing productivity.

Terminal Disclaimer

5. The terminal disclaimer filed on 6/18/2004 disclaiming the terminal portion of any patent granted on this application, which would extend beyond the expiration date of US 6,676,752 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

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6. Applicant's arguments filed 6/18/2004 have been fully considered but they are not persuasive.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Hirota et al teaches a hydride of nitrogen, such as NH_3 , and a group III element and a halogen molecule are caused to react with each other to generate a halide of the group III element. Then, as the hydride of nitrogen and the halide of group III element are caused to react with each other, a group III-V nitride semiconductor is formed ([0023]). Hirota et al also teaches iodine (I_2) may be introduced into the reaction tube instead of HCl to form a halide of the group III element from Ga ([0055] and [0058]). Vaudo et al teaches reacting GaCl , which is a halide of Ga, by reacting gallium metal with HCl and then reacting GaCl with NH_3 to form GaN . Hirota et al clearly teaches a halide of Ga formed from HCl or I_2 can be reacted with NH_3 to form GaN . Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Vaudo et al by using I_2 instead of HCl , as taught by Hirota et al, because substitution of known equivalents for the same purpose is held to be obvious (MPEP 2144.06).

Applicants' argument that there is no reasonable expectation of success is noted but is not found persuasive. Applicants allege that there is no indication that iodine vapor cracked in a plasma system would be suitable as chunks in a boat in a flowing CVD system. Hirota et al does

not teach cracking iodine vapor. Hirota et al teaches supplying iodine vapor to a Ga source to form a Ga halide compound, which is then reacted with a product of nitrogen plasma and hydrogen, NH_x (col 13, ln 30 to col 14, ln 50). Furthermore, independent claim 1 does not require chunks of iodine in a boat and although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a flow through system (pg 2)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The claims are directed to flowing vapor, not to a flow-through system.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Hirota et al is not relied upon as teaching a flow through system, Vaudo et al teaches this limitation. Also, Hirota et al is relied upon solely as a teaching of using Iodine vapor instead of HCl to form a Group III metal halide, which can react with NH_3 to form a Group III nitride.

Applicants argument that it is believed improper to combine Jain's one boat with Vaudo's one boat to arrive at applicants' two boat process is noted but is not found persuasive. This argument is viewed as mere attorney argument, which lacks evidence; therefore is not

persuasive. Furthermore, the combination of Vaudo et al Hirota et al teaches a process of supplying iodine vapor to a boat of gallium metal to form a gallium halide. The combination of Vaudo et al and Hirota et al is silent to the method used to supply iodine. Jain et al teaches a method of supplying iodine vapor is vapor deposition process by using a boat of iodine and heating the boat to vaporize the iodine. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al and Hirota et al by using any conventionally known process of supplying iodine vapor, such as the process taught by Jain, which form iodine vapor by heating a boat of iodine.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the growth rate, thickness and quality of the MN product can be controlled in a fine tuning process) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Shimoyama et al (US 5,868,834) teaches a vapor phase epitaxy process, where there is no particular restriction on the halide gas or halogen gas, for example, HI or I₂ can be used (col 2, ln 1-67).

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Shimoyama et al (US 5,827,365) teaches HI and I₂ are equivalents for manufacturing III-V semiconductors (col 2, ln 30-40 and col 3, ln 1-20).

Steele (US 4,279,670) teaches a container **110** for producing iodide vapor and the iodide vapor is passed through zinc arsenide to form a reactive substance, which deposits on a gallium arsenide substrate (col 4, ln 40-60 and col 7, ln 1-67).

Moon et al (US 3,856,585) teaches a hydrogen halide is used as a transporting gas and is passed over a III-V source material and deposition takes place on a substrate (abstract).

Vaudo et al (US 2002/0166502) teaches a (Ga,Al,In)N deposition using HVPE involving the reaction of HCl and ammonia at pressure of from about 10-800 Torr ([0048]-[0053]).

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

